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Special issue paper

Mindfulness and positive activities at work: Intervention effects on motivation-related constructs, sleep quality, and fatigue

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Positive psychology research is increasingly being transferred to organizational contexts, and organizations are increasingly striving for healthier and more motivated employees. In this study, a three-week self-instructed online intervention which combines positive activities and mindfulness was developed and evaluated using a randomized-controlled group design with employees. All exercises could be easily integrated into the daily working routine. The intervention is based on broaden-and-build theory, the two-component model of mindfulness and the positive-activity model. Results indicate that the intervention is effective in increasing work engagement, hope and sleep quality as well as in reducing fatigue. Practical implications for human resource departments and corporate health management are discussed.

Practitioner points

- A three-week mindfulness intervention can increase work engagement, hope, sleep quality, and reduce fatigue.
- Such activities can easily be integrated into the workday and thus, represent a realistic way for employees to improve motivation and reduce health impairment.

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A major part of personal happiness and well-being is under one's own control (Lyubomirsky, Sheldon, & Schkade, 2005). However, research shows that simply striving for happiness is not enough to become happier (Fredrickson, 2008). In positive psychology research, different ways to pursue happiness have been identified. Two options to increase happiness are to engage in positive activities, like being kind to others, or learning mindfulness meditations. Positive activities refer to 'treatment methods or intentional activities aimed at cultivating positive feelings, positive behaviours, or positive cognitions' (Sin & Lyubomirsky, 2009, p. 467). Studies show positive effects of interventions containing positive activities and mindfulness exercises on well-being (Sin & Lyubomirsky, 2009), engagement (Ouweneel, Le Blanc, & Schaufeli, 2013), and the reduction of depression (Sin & Lyubomirsky, 2009). Research has also shown physical benefits to positive activities such as greater movement and leaving the office earlier (Chancellor, Layous, & Lyubomirsky, 2015).

Comparatively, little literature exists on the effect of positive activity interventions (PAIs) or mindfulness in the organizational context (Meyers, van Woerkom, & Bakker, 2013) despite their practical relevance. Although there are a number of studies which have evaluated the effectiveness of PAIs or mindfulness for workers, there are still many issues that we need to understand, including whether they have an effect on outcomes other than well-being. In a recent qualitative review, Eby et al. (2019) highlighted that there is substantial variation in studies to date which evaluate mindfulness training interventions for employees, including the stated aim, expected outcome, delivery method, and time duration of the training material. Moreover, there are variations in the purpose of research on PAIs, with some research aiming to understand how they work, while others aim to evaluate the overall effectiveness of a multi-faceted intervention for a cohort of workers (e.g. Levett, Coughlan, Longridge, Roumeliotis, & Adams, 2019; Mills, Fullagar, & Culbertson, 2016). Our study adopts the latter approach and looks at the impact of combining PAIs with mindfulness on both health impairment (i.e. sleep quality and fatigue) and motivational (i.e. hope and work engagement) outcomes amongst employees. There are a number of theoretical reasons why such a combination should be beneficial.

The broaden-and-build theory of positive emotions (Fredrickson, 2001) posits that positive emotions broaden our thought and action repertoire, which in turn is associated with better decision-making, problem-solving, and proactive behaviour (Fay & Sonnentag, 2012; Hayward, Forster, Sarasvathy, & Fredrickson, 2010). Furthermore, Gillet, Lafrenière, Huyghebaert, and Fouquereau (2015) demonstrated that autonomous motivation was related to performance via positive affect. Thus, any positive activity which prompts this broaden-and-build mechanism should have similar positive outcomes. In line with this, Chancellor et al. (2005) found that recalling positive events at work is associated with feeling happier.

However, positive activities require effort to perform and so people must be open to experience in the first place in order to build resources and become more active (Fredrickson, 2008). Practice is an important aspect of any positive psychology activity (PPA) and engaging in PPAs may prompt self-regulation processes which are effortful (Eby et al., 2019; Sitzmann & Wang, 2015). The two-component model of mindfulness (Bishop et al., 2004) would suggest that mindfulness operates in such a way as to promote openness to experience through the cultivation of a state of non-judgemental awareness. Mindfulness is defined by Brown, Ryan, & Creswell, 2007, p. 212) as 'a receptive attention to and awareness of present moment events and experiences'. Importantly, mindfulness is not simply an attentional process, but also has an attitudinal component, whereby

mindfulness is permeated with an attitude of open minded curiosity (Hyland, Lee, & Mills, 2015). We therefore posit that exercises which combine mindfulness and positive activities can lead to openness for experiences, positive emotions, and thereby can broaden thought-action repertoires, as hypothesized in broaden-and-build theory (Fredrickson, 2001). In line with this, a study by Pogrebtsova, Craig, Chris, O'Shea, and González-Morales (2018) found that a mindfulness intervention or combined mindfulness with emotion reappraisal intervention in students led to growth in positive affect and decline in negative affect over the course of 5 days.

Mindfulness activities involve the systematic retraining of awareness and non-reactivity which allows individuals to consciously choose the thoughts and emotions one wants to identify with, rather than only reacting to such thoughts and emotions (Chambers, Gullone, & Allen, 2009). Thus, they require effort and self-control and so, individuals must perceive that such effort is worth it. For example, Molina and O'Shea (2020) found that during recession (arguably a context of low resources), participants who engaged in a mindful emotion regulation intervention showed a more positive relationship between work engagement and proactive behaviours only when supervisor justice was low. This highlights that the effort involved in using mindfulness must be perceived to serve some useful purpose. In addition, mindfulness has been shown to be beneficial in emotion regulation and reducing emotional exhaustion (Hülsheger, Alberts, Feinholdt, & Lang, 2013) and can serve as a segmentation strategy to increase work-life balance (Michel, Bosch, & Rexroth, 2014, Rexroth, Michel, & Bosch, 2017). Thus, it is beneficial in terms of promoting detachment, sleep quality, and duration (Hülsheger et al., 2013; Michel et al., 2014).

Positive activities, sometimes referred to as positive psychology activities (PPAs), are defined as 'simple, intentional and regular practice meant to mimic the myriad of healthy thoughts and behaviours associated with naturally happy people' (Lyubomirsky & Layous, 2013; p. 57). A criticism of PPAs is that not everyone benefits from the same activities (Layous & Lyubomirsky, 2014). Thus, incorporating choice and variety into interventions have been identified as important design features in the positive-activity model (Lyubomirsky & Layous, 2013). This aligns with research designs which focus on evaluating multi-faceted interventions (e.g. Levett et al., 2019; Mills et al., 2016) which aim to evaluate the effectiveness of the whole intervention rather than understanding the mechanisms through which any specific intervention activity operates. Thus, the so-called person-activity fit is defined by how much a person likes and benefits from a certain activity. Schueller (2010) asked participants for their preference for different positive psychology exercises and found a correlation between the preference and effectivity of the exercise. In this study, we consider the active involvement of participants in the design of the intervention.

To test our propositions, we developed and evaluated an online self-training intervention containing three modules. This is in line with research showing mindfulness and PAIs can be applied online (Cavanagh et al., 2013; Luthans, Avey, & Patera, 2008; Michel et al., 2014; Ouweneel et al., 2013; Seligman, Steen, Park, & Peterson, 2005) making them cost-effective (Tate & Zabinski, 2004) and applicable in many different settings. The intervention starts with mindfulness exercises to help participants to turn their attention from daily routines to the current moment, to promote openness for experience, and to broaden thought-action repertoires (Bishop et al., 2004; Cavanagh & Spence, 2012; Seiferling & Michel, 2017). We assume that such openness to experience should promote curiosity and openness to trying positive activities. Then, the intervention continues with a variety of positive activities that are instructed and can be freely

combined by participants in the last module of the intervention. This involvement of participants should result in high person-activity fit.

This study contributes to the literature in three ways. First, it is the first study combining mindfulness and positive activities in a theoretical framework. Past research has suggested that there is benefit to varying activities in an intervention (Sheldon & Lyubormirsky, 2007), and for that purpose, we integrate broaden-and-build theory and the two-component-model of mindfulness and suggest that mindfulness exercises can lead to an increase in resources that are needed to carry out positive activities. Second, the study takes into account the effects of person-activity-fit (Lyubomirsky & Layous, 2013) on the effectiveness of positive psychology interventions in the working context by actively involving participants in the design of the intervention programme. This is a possible way to use existing research findings and make them applicable for the development of interventions in the organizational context. Third, the study adds to the recent tendency of extending positive psychology to the field of industrial and organizational psychology. Thus, it offers practical implications for companies that strive to increase these two aspects in their employees.

Positive psychology and mindfulness interventions in the work context

Positive psychology is a research direction that examines positive subjective experiences and positive individual traits and feelings (Seligman & Csikszentmihalyi, 2000). One aspect that is examined in positive psychology is how happiness can be pursued and increased (Seligman et al., 2005). Emerging research has provided preliminary support for combining mindfulness and positive activities (Molina & O'Shea, 2020; Pogrebtsova et al., 2018). As research on PPAs in organizations moves forward, we need to know both why a specific activity works (e.g. Pogrebtsova et al. 2018; Steidle, Hoppe, Gonzales-Morales, Michel, & O'Shea, 2017), as well as whether entire intervention programmes (which are a more realistic method through which organizations actually deliver such interventions) are effective. In this research, we adopt the latter approach as we were interested in the overall impact of the intervention programme. However, we acknowledge the need to adopt both approaches in order to progress our understanding of how and why such intervention work in organizations (Michel, O'Shea, & Hoppe, 2015).

Using FMRI technology, Modinos, Ormel, and Aleman (2010) demonstrated that mindfulness meditation affected participants' reappraisal of emotional stimuli and decreased the extent to which participants experienced negative emotional responses. Other research has also demonstrated benefits to combining mindfulness with reappraisal and positive activities (e.g. Molina & O'Shea, 2020; Pogrebtsova et al., 2018). This research supports the notion that mindfulness can effectively be combined with positive activities.

To support people in integrating more positive activities in their everyday life, different intervention programmes have been developed and evaluated. Based on a categorization by Lyubomirsky, Sheldon, et al. (2005), positive activities can be divided into three different categories: behavioural, cognitive, and volitional. PPAs and mindfulness are theoretically grounded in self-regulation (Chambers et al., 2009; Forgas, Baumeister, & Tice, 2009; Michel et al., 2014), and this categorization aligns well with theories of self-regulation which incorporate behavioural, cognitive, and volitional processes (Carver & Scheier, 1981; Frese & Zapf, 1994; Gollwitzer, 2008). Thus, in this study we included activities from all three categories. *Behavioural activities* contain behaviours that are actively carried out and noticeable for other people. As behavioural activities, we chose an 'act of kindness' (Layous, Lee, Choi, & Lyubomirsky, 2013; Layous

et al., 2012; Lyubomirsky, Sheldon, et al., 2005; Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006; Sheldon, Boehm, & Lyubomirsky, 2013) and a 'letter of gratitude' (Chan, 2010). Past research has demonstrated that both of these interventions increase happiness when they are relationship-focussed, rather than self-focussed or when compared to a control group (O'Connell, O'Shea, & Gallagher, 2016). *Cognitive activities* aim to promote positive thinking. For our study, we chose 'thinking about positive experiences' (Layous & Lyubomirsky, 2014; Seear & Vella-Brodrick, 2013) and 'identifying personal strengths' (see Seligman et al., 2005). *Volitional activities* like trying to reach one's goals (Sheldon & Houser-Marko, 2001) have their basis in motivation science and comprise the third category. Such activities are predominantly motivational in nature, asking individuals to think in a certain way but can also have behavioural aspects. For this category, we selected the exercise 'writing about one's best future' (Layous, Lee, et al., 2013). Past research has demonstrated that such activities can motivate proactive behaviours (Strauss, Griffin, & Parker, 2012).

Recently, positive psychology has been transferred to the work context (Mills, Fleck, & Kozikowski, 2013). Employees can be instructed to carry out positive activities at work like being kind, showing gratitude to colleagues, or identifying character strengths that help them do their job. In a meta-analysis, Meyers et al. (2013) examined 15 studies that carried out positive psychology interventions in the organizational context and found well-being as the most examined outcome variable. Constructs like flow, work engagement, empowerment, and job satisfaction are common outcome variables examined in this context (Bakker & Daniels, 2013; Mills et al., 2013). Ouweneel et al. (2013) examined the effects of an online intervention consisting of a combination of different positive activities like being kind at work or setting goals for the personal career on self-efficacy, positive emotions, and engagement. The authors found an increase in positive emotions and self-efficacy in an experimental group in comparison to a control group but no significant effect for work engagement. They found that work engagement was only significantly increased in participants who initially had low levels of engagement.

Additionally, there are interventions that focus on learning mindfulness in the workplace (Cavanagh et al., 2013). Mindfulness is an ancient Buddhist practice that increases awareness for thoughts, emotions, and sensations. Bishop et al. (2004) proposed a two-component model of mindfulness: Mindfulness emerges from actively drawing one's attention to current emotional states, thoughts or one's own breathing ('self-regulation of attention') and an orientation to new experiences that is characterized by curiosity and acceptance for every occurring thought and feeling ('orientation to experience'). Today, mindfulness is increasingly applied in modern training or therapeutic programmes to reduce stress and increase mental health (Kabat-Zinn, 1982, 2007; Segal, Williams, & Teasdale, 2002). A meta-analysis (Sin & Lyubomirsky, 2009) showed that mindfulness trainings are one of the most frequently evaluated interventions in the context of positive activities. Mindfulness interventions can also be implemented in the work context and are effective in increasing job satisfaction and decreasing emotional exhaustion (Hülsheger et al., 2013) and increasing work-life balance (Michel et al., 2014). Hyland et al. (2015) gave an overview of selected mindfulness studies in organizational contexts and summarize research showing positive effects of mindfulness interventions on stress reduction and the promotion of mental and physical health, cognitive functioning, performance, and well-being among employees. In a recent qualitative review of 67 mindfulness intervention studies, Eby et al. (2019) found that stress/strain, mindfulness, and well-being were the most common outcomes examined. However, they

also found that self-regulation was examined by over 16% of past studies (Eby et al., 2019). Taken together, past research provides a reasonable guide that focusing on a combination of PPAs and mindfulness activities with behavioural, cognitive, and volitional components should have a variety of positive effects in work contexts.

Effects of mindfulness and positive activities

From the research we discussed in the previous section, there is reasonably strong evidence to indicate that PPAs and mindfulness are beneficial for well-being and health related constructs such as sleep quality and reducing burnout (Eby et al., 2019; Hyland et al., 2015). However, relatively little research has investigated the impact of PPAs and mindfulness on other work-related outcomes. In particular, goal-directed and motivationally oriented outcomes have received little attention. Work engagement and hope are two such variables, and recent research provides preliminary support that PPA and mindfulness influence them (Clauss et al., 2018; Molina & O'Shea, 2020). Thus, in our study, we investigated both types of outcome variables.

Furthermore, we designed our intervention so that it was appealing and interesting to those who most needed it. The 'selection benefit paradox' (Ouweneel et al., 2013) refers to findings demonstrating that participants who profited most from an intervention were those who had lower initial levels of well-being, positive emotions, and engagement. The paradox arises because those same participants were the very ones most likely to drop out of the intervention (Ouweneel et al., 2013). We wanted to address this paradox effect by combining positive activities with mindfulness exercises. Some activities are easier to complete while others require more effort. In designing our intervention activities, we also wanted to include a range of activities that tapped both hedonic (e.g. activities providing pleasure or comfort) and eudaimonic (e.g. activities focussed on seeking to use of or develop the best in oneself; Huta & Ryan, 2010) processes in individuals. Hedonic activities should be easier and quite enjoyable for participants to engage in, but tend to have more short-term beneficial effects, while eudaimonic activities can be more effortful for participants, but have the potential to have longer lasting effects by comparison (Huta & Ryan, 2010). Moreover, the combination of these types of activities should be associated with energetic resources (fatigue, sleep quality) and motivational resources (work engagement, hope). Thus, we included different activities in our intervention. 'Mindfulness', 'act of kindness', 'and thinking about positive experiences' were easier and hedonic in nature while 'letter of gratitude', 'writing about one's best future' and 'identifying personal strengths' required more effort and were eudaimonic in nature.

People who are happier and experience more positive emotions are more generous toward others (Otake et al., 2006). Experiments indicate a causal effect here. Not only does kindness make people happier but also positive emotions lead to more kindness (Isen, Horn, & Rosenhan, 1973; Thoits & Hewitt, 2001). In line with this is the finding that the 'act of kindness' exercise is not a good starter activity in PAIs (Layous, Lee, et al., 2013). The same is conceivable for other positive activities, like expressing gratitude or practising optimism. These activities might also require a certain openness for new experiences.

Broaden-and-build theory (Fredrickson, 2001) explains how openness to experience is built. The basic premise of this theory is that positive emotions can broaden thought-action-repertoires and therefore enable diverse emotions and (new) activities. This is possible because positive emotions lead to increased intellectual, social, or psychological resources which make new thoughts and activities more likely. Fredrickson (2008)

assumes that people have to be open for experience first to build resources and become more active. This corresponds to the 'openness to experience' component of the mindfulness definition (Bishop et al., 2004). Thus, to increase openness to experience, the first module of our intervention (week 1) contained mindfulness exercises. We expect the mindfulness exercises to result in a more mindful state:

Hypothesis 1a. Compared with participants in a control group, participants in an intervention containing work-related mindfulness exercises and positive activities will show increased mindfulness.

The positive activities, fostered in week 2 and 3 of the intervention, should in turn increase positive affect (Fredrickson, 2008; Otake et al., 2006). The increase in positive affect through positive activities is the basic premise of the positive-activity model (Lyubomirsky & Layous, 2013). The model also indicates how exactly a PAI should be designed to be most effective. According to the model, variety, sometimes called the 'spice of happiness' (Sheldon et al., 2013), increases the effectiveness of PAIs (Layous & Lyubomirsky, 2014; Seligman et al., 2005). For this reason, we taught participants five different positive activities in Module 2 of our intervention.

In addition to being legitimately efficacious, positive activities are more effective when people are motivated to perform them (Lyubormirsky, Dickerhoof, Boehm, & Sheldon, 2011), and so the fit of the activity with the needs of the individual is important to take into account. Person-activity-fit describes the fit between the person and the PAI activity (Lyubomirsky & Layous, 2013). A good fit exists when people can choose the activity that they prefer, that they find easy to do and that conveys the feeling to obtain the highest benefit (Schueller, 2010). Therefore, in Module 3 of our intervention participants can choose between different activities they wanted to pursue. PAIs are most effective when good person-activity-fit exists (Layous & Lyubomirsky, 2014; Schueller, 2010). Drawing on the premise of the positive-activity model that positive activities should promote positive affect, we assume:

Hypothesis 1b. Compared with participants in a control group, participants in an intervention containing work-related mindfulness exercises and positive activities will show increased positive affect.

Intervention effects on motivation-related constructs (work engagement and hope)

To date, positive activity research in the workplace has broadly speaking, focussed on outcomes related to well-being and stress/strain reduction (Eby et al., 2019). Less attention has been paid to whether positive activities have other benefits in terms of enhancing motivation or motivation-related variables, although there have been strong arguments put forward that this should be investigated (Hyland et al., 2015). Researchers have also called for a focus on the returns from mindfulness training for organizations, including a focus on valued outcomes such as performance (e.g. Castille, Sawyer, Thoroughgood, & Bucker, 2015).

Given that motivation has a direct link to performance, there is substantive practical appeal to investigating such relationships. Hyland et al. (2015) suggested that enhancing motivation was a workplace application of mindfulness that warranted further investigation. One obvious motivational construct to investigate is work engagement. Work

engagement, defined as a positive motivational work-related state characterized by vigour, dedication, and absorption (Bakker, Demerouti, & Sanz-Vergel, 2014; Schaufeli, Salanova, González-romá, & Bakker, 2002), has been linked with work performance (Salanova, Agut, & Peiró, 2005; Xanthopoulou, Baker, Heuven, Demerouti, & Schaufeli, 2008) and proactive behaviours (Salanova & Schaufeli, 2008; Sonnentag, 2003). Showing whether positive activities in the workplace can impact work engagement would advance research beyond the realm of their impact on well-being.

In line with the assumptions of the broaden-and-build theory (Fredrickson, 2001) and the two-component model of mindfulness (Bishop et al., 2004), a combination of mindfulness and positive activities should increase work engagement through the development of a mindful attitude, the building of positive emotions, and the promotion of openness for new experiences. Studies have shown that positive emotions can lead to higher work engagement (Schaufeli & Van Rhenen, 2006) and enable approach behaviours (Cacioppo, Gardner, & Berntson, 1999). One example for such an behaviour is the setting of goals and engagement to attain these goals (Ouweneel et al., 2013). Mindfulness has been associated with lower emotional exhaustion (Hülsheger et al., 2013) and enhanced engagement (Leroy, Anseel, Dimitrova, & Sels, 2013). Thus, we expect that the intervention activities will lead to higher work engagement.

Hypothesis 2. Compared to participants in a control group, participants in the intervention containing work-related mindfulness exercises and positive activities will show increased work engagement.

Kroon, Menting, and van Woerkom (2015) suggest that mindfulness may be useful in motivating employees through its benefits for harnessing personal and motivational resources. Hope is one such state or personal resource, defined as 'a positive motivational state that is based on an interactively derived sense of successful agency (goal-directed energy) and pathways (planning to meet goals)' (Snyder, Rand, & Sigmon, 2002; p. 8). It is a motivational state beneficial for goal-directed pursuits. Thus, hope exists when (1) people feel capable of reaching their goals and thinking about workable routes to get there and (2) they think that they can and want to use these routes to reach their goals. In a similar vein, Pekrun (2006) defines hope as a prospective anticipatory, achievement emotion in his control-value theory of achievement emotions. However, Reis and Hoppe (2015) distinguish both theoretically and empirically (as shown by a CFA) that affective well-being and hope are distinct constructs and that change in affective well-being correlates with change in hope. The authors conclude that change in affective well-being can mark a starting point for building hope which is highly relevant for our intervention. We postulate that the intervention increases positive affect (proximal outcomes) which in turn builds hope (more distal outcome).

The concept of hope has recently gained popularity in human resource development as it is connected with higher performance levels (Luthans & Jensen, 2002). Other studies also find causal relationships between positive emotions and hope (Reis & Hoppe, 2015) which is in line with broaden-and-build theory (Fredrickson, 2001). Positive retrospective emotions on one day can lead to increased hope on the next day (Ouweneel, Le Blanc, Schaufeli, & van Wijhe, 2012). Clauss et al. (2018) demonstrated that a daily work activity based on recalling the positive meaning of events that occurred throughout the day increased hope and optimism for participants with a high need for recovery. In a similar way to their intervention, we argue that the combination of mindfulness and positive

activities helps to raise awareness about situations in which expectations of positive outcomes have been met in the past and prime beliefs about one's own capability and expectation of achieving one's work-related goals (Clauss et al., 2018). Two positive activities that will be used in the intervention directly address the two components of hope, for example 'imagining one's best future self' (Seear & Vella-Brodrick, 2013) or 'trying to reach one's goals' (Sheldon & Houser-Marko, 2001). Thus, we expect that the intervention activities will build hope.

Hypothesis 3. Compared with participants in a control group, participants in an intervention containing work-related mindfulness exercises and positive activities will show increased hope.

Intervention effects on sleep quality and fatigue

A lot of studies show positive effects of mindfulness on health. Mindfulness correlates with less emotional exhaustion at work which is a component of burnout and can result from stress (Hülsheger et al., 2013). Mindfulness exercises can also be integrated into therapies for depression (Segal et al., 2002) and can reduce anxiety symptoms (Cavanagh et al., 2013). Positive affect has also shown to be positively related to health (Moskowitz & Saslow, 2014).

Two indicators for health that relate to burnout, depression, and general health (Akerstedt, Kecklund, Alfredsson, & Selen, 2007) are fatigue and sleep quality. Given that burnout and related variables are defined as an end state of long-term stress (Maslach & Schaufeli, 1993), it is more appropriate to focus on more proximal states that could be influenced with more immediate effect. Fatigue and sleep quality are two such proximal states. Effects of both positive affect (Ong et al., 2013) and mindfulness (Brand, Holsboer-Trachsler, Naranjo, & Schmidt, 2012; Hülsheger, Feinholdt, & Nübold, 2015) on sleep quality have previously been found. Furthermore, Davidson et al. (2003) found that mindfulness meditation improved energy levels (the opposite of fatigue) in high-stress jobs. Clauss et al. (2018) found that their positive meaning activity decreased fatigue amongst caregivers. Experiencing positive emotions and openness to experience as suggested by the broaden-and-build theory (Fredrickson, 2001) and the two-component model of mindfulness (Bishop et al., 2004) helps to build resources and to become more active (Fredrickson, 2008). Analogous to the effect of resources built by the intervention on motivational variables like work engagement and hope, we assume that the intervention will reduce health impairment as indicated by enhanced sleep quality and reduced fatigue.

Hypothesis 4. Compared with participants in a control group, participants in an intervention containing work-related mindfulness exercises and positive activities will show increased sleep quality (Hypothesis 4a) and reduced fatigue (Hypothesis 4b).

Method

Design

We applied a randomized-control group design with three measurement points in this study. All data were collected through online self-report questionnaires. Participants filled out the

first questionnaire when registering for the study at time 1. After the end of the registration period, participants were randomly assigned to either the experimental or the waitlist control group who were offered the intervention after the last measurement in week 7.

The experimental group were given access to the e-learning platform Moodle (Dougiamas, 2011) containing all of the material needed for the intervention. They were encouraged to familiarize themselves with the e-learning platform and start the intervention in the following week. Both groups filled out a questionnaire after the experimental group finished the intervention in week 5 (post) and one last questionnaire two weeks later in week 7 (follow-up).

Participants with various occupational backgrounds in Germany were recruited by announcement letters and flyers. The study was described as a scientific research project investigating mindfulness and positive activities, offered as a free online self-training intervention. The announcement was made in different social media networks (Facebook, Xing, LinkedIn), professional e-mail list servers (Rauen Coaching Newsletter, MWonline), and a snowball sampling approach (Lewis-Beck, Bryman, & Liao, 2004) through the first authors' professional and social contacts.

Sample

A total of 268 people registered to participate in the study and completed the first questionnaire. All participants were randomly assigned to either the experimental group (n = 139) or the waitlist control group (n = 129). During registration, participants were told that they would be randomly assigned to one of two groups. They were instructed that groups would only differ with regard to the order of questionnaires and training instructions. Participants filled in the pre-questionnaire in the first week of our study (Week 1). On the following weekend, experimental group participants started with the intervention. They received training instructions for the following three weeks. After four weeks, all participants completed the fourth questionnaire. This was the post-questionnaire for the experimental group. Two weeks later, all participants were asked to fill in a third questionnaire. This was the follow-up measurement for the experimental group. After that the control group participants started with the intervention (see Figure 1).

In the experimental group, 80 participants (58%) completed the post-questionnaire and 77 (55%) completed the follow-up-questionnaire two weeks after the intervention programme. Matching pre-measures could be found for 76 of the participants with post-measures and for 74 follow-up-measures. We excluded participants who did not regularly do the daily exercises during the three-week intervention programme. We asked participants at the end of each week the following question: 'How often did you practice your exercise last week?' Participants answered on a five-point Likert scale: 1 = never; 2 = rarely; 3 = sometimes; 4 = most days; 5 = every day. Participants who indicated that

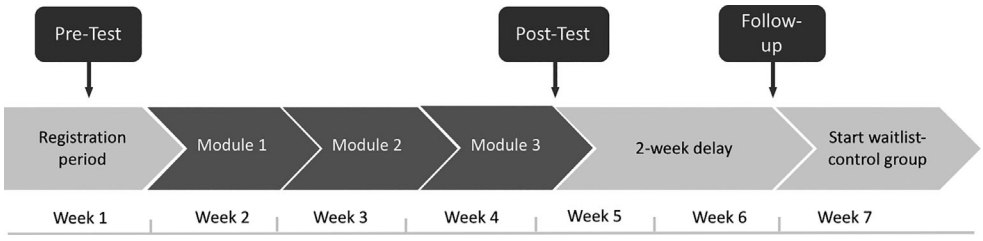

Figure 1. Study design and time course

they did never or rarely completed the exercise were excluded from the study. This results in a final sample of 61 participants in the pre-post-sample and 60 participants in the pre-follow-up sample. We conducted univariate analyses of variance and chi-square tests to analyse whether participants in the final sample differed from those who dropped out. The only difference found here is the higher dropout rate of younger participants (pre-post-dropout: $F(1) = 4.354$, $p < .05$; pre-follow-dropout: $F(1) = 7.382$, $p < .01$).

In the control group, 129 participants completed the pre-questionnaire. 121 participants (94%) completed the post-questionnaire, and 101 (83%) the follow-up-questionnaire. 108 post-measures and 92 follow-up measures could be matched with their corresponding pre-measures. This results in a final pre-post-sample of 108 participants and pre-follow-up sample of 92 participants in the control group. Univariate analyses of variance and chi-square tests showed that more control group participants that dropped out had done autogenous training, progressive muscle relaxation (PMR), or other relaxation techniques before participating in the study in comparison to participants who did not drop out ($X^2(1) = 2.781$, $p < .10$).

However, the final pre-post-sample consisted of 169 participants. They averaged 41.11-years-old ($SD = 9.74$) with an average tenure in their organization of 7.99 years ($SD = 8.085$) on average. Most of the participants were female (67.5%). 76.3% held a university degree. Two-thirds of the participants live in a partnership (69.2%), and almost half of them have one or more children (45%). The sample comprised people working in different sectors, for example health and social services, processing and manufacturing, science and education, or other service sectors. Most participants had no experience in relaxation techniques like autogenous training, PMR or other relaxation techniques (73.9%). The pre-follow-up sample comprised 152 participants. The sample composition remained stable for the reduced sample size.

We checked the randomization for both sample compositions. In the pre-post-sample, univariate ANOVAs showed a difference between control and experimental group with regard to age ($F(1) = 5.976$; $p < .05$) as well as openness ($F(1) = 2.983$; $p < .10$) and resilience ($F(1) = 3.023$; $p < .10$) measured at baseline. Participants in the experimental group were slightly older than participants in the control group while participants in the control group scored higher on openness and resilience. In the pre-follow-up sample, the only difference found was in the higher age of experimental group participants ($F(1) = 9.003$; $p < .01$). All other study and demographic variables at pre-test did not differ between the groups.

Intervention

We created an online intervention to train mindfulness and positive activities in the work context building on the positive-activity model (Lyubomirsky & Layous, 2013), broaden-and-build theory (Fredrickson, 2001) and the two-component model of mindfulness (Bishop et al., 2004). The intervention consisted of three modules practised over three consecutive weeks.

The mindfulness meditation exercises were based on mindfulness-based cognitive therapy (MBCT; Segal et al., 2002) and mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982, 2007) exercises and were adapted from Michel et al. (2014). The exercises concerning positive activities were adapted from existing research in positive psychology (Layous, Nelson, & Lyubomirsky, 2013; Layous et al., 2012; Seligman et al., 2005). We used positive activities that had been empirically shown to be effective and that could easily be transferred to the working context.

Module 1: Integrating mindfulness into daily routine

The first module aimed to introduce mindfulness according to the two-component model (Bishop et al., 2004) and at integrating a basic mindfulness exercise into the participants' daily routine. The mindfulness module was based on the theoretical assumptions of the broaden-and-build theory (Fredrickson, 2001) and should help participants to build openness for experience and to perform positive activities such as kindness or gratitude in module 2 and 3. The content of this module is based on the mindfulness intervention designed by Michel et al. (2014). The module consisted of theoretical input about the mindfulness concept and practical exercises. First, we introduced mindfulness and the two components, self-regulation of attention and orientation to experience. Participants learned about mindfulness research and the Buddhist roots of the concept. Additionally, they were instructed how to integrate mindfulness exercises into their daily routine using a short example story based on the aspect of being open through mindfulness stated by Fredrickson (2008). We included a 7-minute audio instruction guiding participants to sit quietly, focus on their breathing and bringing their attention back to the breath when their minds wandered off. Then, we introduced the daily exercise, a slightly adapted version of the three-minute breathing space exercise by Segal et al. (2002). Participants were asked to practice the three-minute exercise every day in the following five working days while being at work (e.g. in a short break) or after work.

Module 2: Positive activities in the working context

The second module consisted of five different exercises related to five different positive activities. Participants were advised to carry out the five exercises on five consecutive working days. On the first day, participants were asked to carry out the 'one positive experience' (Seligman et al., 2005) exercise. They were asked to think about and name one positive experience that had occurred that day in their working context, for example a successful presentation. In the 'act of kindness' (Layous et al., 2012) exercise on the next day, participants were asked to do something kind for someone at work like helping a colleague with a software-related problem. On the third day, participants completed the 'letter of gratitude' (Seligman et al., 2005) exercise and wrote a letter to someone in their working context for something they were grateful for, for example, a colleague who they can always talk to when they need help. On day four, participants were asked to 'identify personal strengths' (Seligman et al., 2005) with regard to their work, like creativity, or authenticity. The module ended with 'writing about one's best future self' (Layous, Lee, et al., 2013). Participants were asked to write a letter to themselves and should imagine how their perfect work-related future could be. Five different activities were used to ensure that there was a high variety as proposed in the positive-activity model (Layous & Lyubomirsky, 2014). The five activities also covered all three categories of positive activities (behavioural, volitional, cognitive) to ensure variety. Each day participants received a short introduction to the activity containing example stories for the respective activity in a workplace setting. Additionally, participants received a worksheet with guiding questions to reflect their daily activity.

Module 3: Creating person-activity-fit

To guarantee person-activity-fit as proposed in the positive-activity model, the third module built on the positive activities in module 2. After completing, the second module participants were asked to fill out a short questionnaire in which they stated how much

they liked the different activities, how easy they found to complete them, and how much they benefited from them. After reflecting on this, they were instructed to pick the activities they liked the most. In this way, they could arrange an individual timetable for module 3 consisting of those activities that they wanted to repeat. They received information and worksheets for the different activities. The 'Kindness', 'Gratitude' and 'Positive experience' activities were exact repetitions of module 2 while the 'Future self' and 'Strengths' activities were slightly changed as they could not be repeated meaningfully. Participants who chose the 'Future Self' Activity were instructed to think of possible sub-goals that are necessary to let their 'best future self' they described in module 2 become true. Participants who chose the 'Strengths' activity were instructed to actively apply the strength they identified in module 2 during the day for which they chose this activity.

All participants were reminded daily to complete their exercises. When registering for the study, they could decide whether they wanted to be reminded via SMS or e-mail. Additionally, in modules 2 and 3 they were asked to send a keyword that described the content of their positive activity on a daily level via SMS or E-Mail to ensure that they had completed the task and adequately reflected on it.

Measures

We assessed all measures at pre-test, post-test, and follow-up regarding the preceding 7 days except for demographic variables which were measured only at baseline. All questionnaires were in German; in cases where a German version was not available, they were translated with a translation/back translation procedure (Brislin, 1970). All scales showed satisfying reliabilities with values for Cronbach's alpha between.702 and.970 (see Table 1 for Cronbach's alphas).

Mindfulness was assessed using the 7-item version of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2006). Items were rated on a 5-point Likert scale (1 = *not at all*; 5 = *extremely*). For example, 'I am preoccupied by the past'.

Positive affect was measured with the 10-items from the Positive and Negative Affect Schedule Scale (PANAS Scale; Watson, Clark, & Tellegen, 1988). Participants rated to what extent they had different emotions like 'interested' or 'excited' by reference to the last week. Items were rated on a 5-point Likert scale (1 = *not at all*; 5 = *extremely*).

Work engagement was assessed with the 9-item German version of the Utrecht Work Engagement Scale (UWES-9; Schaufeli, Bakker, & Salanova, 2006). Items were rated on a 7-point Likert scale (1 = *never*; 7 = *always*). For example, 'At my work, I feel bursting with energy'.

Hope was assessed with the state hope scale (Snyder et al., 1991) consisting of six items. Items were rated on a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). For example, 'There are lots of ways around any problem that I am facing now'.

Fatigue was assessed with the single item scale 'How fatigued do you currently feel?' (van Hooff, Geurts, Kompier, & Taris, 2007). The item was rated on a 5-point Likert scale (1 = *not tired at all*; 5 = *very tired*).

Sleep Quality was measured with the single item 'How do you evaluate this week's sleep?' as used by Hahn, Binnewies, Sonnentag, and Mojza (2011). It was rated on a 5-point Likert scale (1 = *very bad*; 5 = *very good*).

Table 1. Descriptives and correlations among study variables

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 Control group (0)	–																							
2 Gender (men 1, women 2)	–		−.009																					
3 Age	41.08	9.76	−.181	−.009																				
4 Mind T1	3.27	0.56	−.055	−.181	.145	(.70)*																		
5 Mind T2	3.28	0.56	−.220	−.055	.273	.634	(.73)																	
6 Mind T3	3.28	0.57	−.116	−.220	.304	.658	.831	(.73)																
7 PA T1	3.11	0.67	−.092	−.116	−.008	.393	.326	.316	(.89)															
8 PA T2	3.22	0.74	−.229	−.092	.105	.388	.500	.461	.491	(.89)														
9 PA T3	3.26	0.80	−.098	−.229	.118	.340	.382	.469	.546	.675	(.94)													
10 WE T1	4.08	1.27	−.042	−.098	.024	.445	.346	.360	.627	.462	.440	(.95)												
11 WE T2	4.13	1.36	−.139	−.042	.104	.459	.494	.475	.506	.606	.518	.811	(.96)											
12 WE T3	4.08	1.40	−.145	−.139	.141	.410	.475	.494	.528	.616	.656	.785	.856	(.97)										
13 Hope T1	3.34	0.82	−.059	−.145	.015	.538	.459	.498	.626	.450	.470	.593	.559	.573	(.89)									
14 Hope T2	3.48	0.79	−.213	−.059	.087	.458	.554	.547	.540	.600	.560	.518	.617	.600	.755	(.89)								
15 Hope T3	3.51	0.83	−.142	−.213	.136	.404	.552	.584	.526	.563	.667	.464	.527	.634	.667	.792	(.91)							
16 FT T1	2.86	0.96	.017	−.142	−.068	−.244	−.231	−.283	−.382	−.273	−.327	−.228	−.191	−.235	−.236	−.244	−.267							
17 FT T2	2.78	1.08	.101	.017	−.110	−.174	−.309	−.387	−.229	−.391	−.359	−.163	−.270	−.340	−.237	−.342	−.334	.421						
18 FT T3	2.70	1.04	.101	.101	−.157	−.150	−.307	−.373	−.271	−.432	−.467	−.192	−.307	−.414	−.263	−.336	−.401	.363	.506					
19 Sleep T1	3.26	0.94	−.061	.101	−.070	.297	.165	.201	.273	.211	.150	.214	.169	.214	.281	.259	.247	−.281	−.243	−.244				
20 Sleep T2	3.47	0.95	−.167	−.061	.020	.206	.273	.310	.196	.420	.307	.215	.260	.361	.232	.339	.382	−.262	−.420	−.361	.617			
21 Sleep T3	3.54	0.95	−.122	−.167	.029	.268	.340	.350	.240	.466	.407	.201	.290	.342	.267	.436	.433	−.304	−.321	−.450	.604	.652		
22 Openness	3.68	0.56	.082	−.122	−.010	.119	.150	.195	.134	.210	.244	.074	.129	.105	.141	.169	.177	−.139	−.033	−.039	−.079	−.033	−.006	
23 Resilience	3.66	0.47	.060	.082	−.104	.365	.325	.339	.402	.364	.369	.368	.372	.300	.429	.396	.380	−.199	−.158	−.219	.164	.123	.161	.606

Note. Cronbach's alphas are shown in parentheses on the diagonal. Coefficients over [.156] are * p <.05, coefficients over [.19] ** p <.01.
T1 = Pre, T2 = Post, T3 = Follow-up, Mind = Mindfulness, PA = Positive Affect, WE = Work Engagement, FT = Fatigue. Listwise N = 159.

Analysis

We used IBM SPSS Statistics 20 for all analyses. Before conducting the main analyses, we checked data for multivariate outliers, univariate normality, and homogeneity of variance. No outliers were found. Skewness and kurtosis were within the acceptable range for all variables (West, Finch, & Curran, 1995). The box test for homogeneity of covariance matrices revealed no significant deviation of the assumption of homogeneity.

To test our hypotheses, we conducted multivariate analyses to assess the group by time interaction effects on our dependent variables. We conducted our MANOVAs with and without age, openness to experience, and resilience[1] as covariates as we found baseline groups difference in these variables, but present our models without them as the pattern of results remained the same whether we included them or not. We conducted simple contrasts between and within groups to further understand the trend of within subjects effects from pre-test, to post-test and follow-up for the experimental group and the control group, and to understand the between group differences at each time point.

Results

Table 1 provides descriptive information and intercorrelations of variables for the full sample and Table 2 shows the estimated marginal means and standard errors organized by group. Figures 2–4 show the estimated marginal means of the experimental and control groups at each of the three timepoints, and with error bars indicating 95% confidence intervals.

Multivariate interaction effects of group by time would suggest support for our hypotheses, in the case of one of the manipulation checks, mindfulness ($F(1,144) = 4.64$ $p = .011$, $\eta^2 = .06$), and the motivation variables, hope ($F(1,144) = 4.03$, $p = .020$, $\eta^2 = .05$), and work engagement ($F(1,144) = 6.22$, $p = .003$, $\eta^2 = .08$). The multivariate interaction effect was not found for positive affect (one of the manipulation checks) nor fatigue and sleep quality (health impairment variables). However, given the complexity of the data, and the trends observed upon inspection of means and plots, we report univariate contrasts to further explain our findings.

Table 2 shows estimated marginal means and standard errors separately for the experimental and control group and the univariate results of three MANOVAs (one for each measurement point predicting all dependent variables) in order to test whether the experimental and control groups differed in their means at pre, post, and follow-up timepoints. The results suggest no differences between groups before the intervention took place. Once the intervention was completed, the univariate tests indicate small effect sizes on the experimental group levels of positive affect, hope, and sleep quality and moderate effects on mindfulness. At follow-up, only small effect sizes in hope and engagement remained.

Results for the control group point out lack of differences between measurement points across all variables. The findings for the experimental group are described below, organized by type of variable.

[1] Openness to experience *was assessed with 10 German items of the revised NEO-Personality Inventory (NEO PI-R; Ostendorf & Angleiter, 2004). For example, 'I am a curious person'.* Resilience *was assessed with the Ego-Resiliency Scale (Klohnen, 1996). For example, 'I enjoy dealing with new and unusual situations'.*

Table 2. Estimated marginal means, standard error, and results of MANOVAs at pre, post, and follow-up comparing experimental and control group

		Estimated marginal mean (*SE*)			MANOVA univariate tests		
Variable	Group	Pre	Post	Follow-up	Pre $F(1,147)$ *p*-value Partial η^2	Post $F(1,145)$ *p*-value Partial η^2	Follow-up $F(1,147)$ *p*-value Partial η^2
Positive Affect	Control	3.06 (0.07)	3.07 (0.08)	3.19 (0.09)	0.832 *0.363*	6.534 *0.012*	2.791 *0.097*
	Experimental	3.16 (0.09)	3.38 (0.10)	3.41 (0.10)	**0.01**	**0.04**	**0.02**
Mindfulness	Control	3.24 (0.06)	3.17 (0.06)	3.22 (0.06)	0.222 *0.638*	10.099 *0.002*	3.760 *0.054*
	Experimental	3.29 (0.07)	3.47 (0.07)	3.40 (0.07)	**0.00**	**0.07**	**0.02**
Hope	Control	3.30 (0.08)	3.33 (0.08)	3.40 (0.09)	0.508 *0.477*	7.481 0.007	5.178 *0.024*
	Experimental	3.39 (0.10)	3.69 (0.10)	3.71 (0.11)	**0.00**	**0.05**	**0.03**
Work Engagement	Control	4.03 (0.13)	3.97 (0.14)	3.90 (0.15)	0.006 *0.936*	3.360 *0.069*	4.604 *0.034*
	Experimental	4.05 (0.16)	4.39 (0.18)	4.39 (0.18)	**0.00**	**0.02**	**0.03**
Fatigue	Control	2.88 (0.10)	2.88 (0.11)	2.80 (0.11)	0.064 *0.801*	3.234 *0.074*	3.719 *0.056*
	Experimental	2.92 (0.12)	2.55 (0.14)	2.47 (0.13)	**0.00**	**0.02**	**0.03**
Sleep	Control	3.21 (0.10)	3.33 (0.10)	3.44 (0.10)	0.116 *0.734*	5.888 *0.016*	3.189 *0.076*
	Experimental	3.27 (0.12)	3.71 (0.12)	3.72 (0.12)	**0.01**	**0.04**	**0.02**

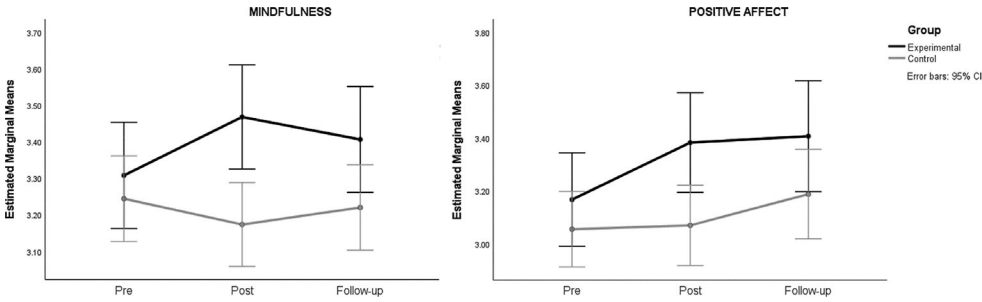

Figure 2. Means of manipulation check variables at all three measurement times for control and experimental group

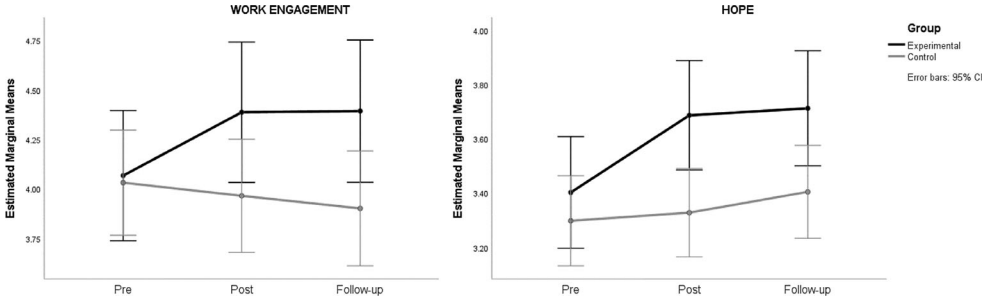

Figure 3. Means of motivation variables at all three measurement times for control and experimental group

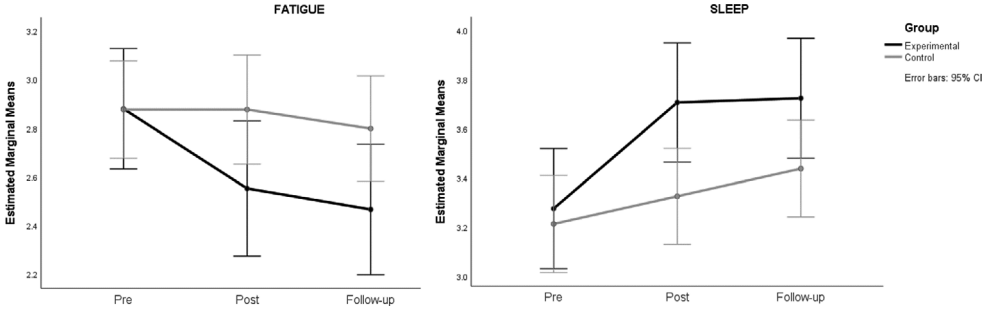

Figure 4. Means of health impairment variables at all three measurement times for control and experimental group

Manipulation checks: intervention effects on mindfulness and positive affect

The repeated measure MANOVA for the intervention group shows medium effect sizes with regard to increases of positive affect, both from pre-test to post-test (partial $\eta^2 = .91$) and from pre-test to follow-up (partial $\eta^2 = .11$). Mindfulness increased from pre to post with a medium effect size (partial $\eta^2 = .09$).

Motivation and Health Impairment Variables

Table 3 shows large effect sizes in hope, increasing in post (partial η^2 = .22) and follow-up (partial η^2 = .18; when compared with the pre-test means). Work engagement shows a similar trend with medium effect sizes (partial η^2 = .13 for post and.10 for follow up). The same trend is shown for the health impairment variables with medium and large effect sizes of changes from pre-test to post and follow-up, both in terms of decreased fatigue (partial η^2 = .08 and.13) and increased sleep quality (partial η^2 = .21 and.19). Results are reported in Table 3.

Discussion

This study aimed to develop and evaluate an online intervention programme to improve motivational and health impairment variables in an organizational context. The intervention contained mindfulness exercises and positive activities based on the theoretical frameworks of the broaden-and-build theory, the two-component model of mindfulness, and the positive-activity model. Hypotheses 1a and 1b stated that mindfulness and positive affect would be increased by the intervention activities. We found that the intervention group increased from pre to post on both of these variables, and also from pre to follow-up for positive affect. Both were significantly different from the intervention group at time 1, although the multivariate group by time interaction was only significant for mindfulness. This seems to point to the immediate (but perhaps not entirely long lasting) effect of the intervention on mindfulness, which dissipates once participants cease the intervention. The increase in positive affect through positive activities is the basic premise of the positive-activity model (Lyubomirsky & Layous, 2013). Mindfulness is more effortful, and so may require continued engagement with the intervention activities to maintain effects. Thus, the experimental manipulation was for the most part successful.

We found robust support for Hypotheses 2 and 3 as indicated by multivariate group by time interactions, and increases in work engagement and hope in the experimental group across time, and which were different in comparison to the waitlist control group at both post and follow-up assessments. Our findings align with past research linking mindfulness with lower emotional exhaustion and higher engagement (Hülsheger et al., 2013; Leroy et al., 2013). Moreover, it advances previous intervention research demonstrating that a positive meaning intervention has an impact on hope for those who have a high need for recovery (Clauss et al., 2018). In our intervention, the combination of PAI with mindfulness may have extended the cohort of workers who can benefit from the intervention by developing a mindful attitude, positive emotions, and promoting openness to new experiences, in line with broaden-and-build theory (Bishop et al., 2004; Kroon et al., 2015).

We also saw evidence that our intervention resulted in improvements in sleep quality and fatigue across time, in support of Hypothesis 4, and aligning with past research demonstrating associations between mindfulness and sleep quality (Brand et al., 2012; Hülsheger et al., 2015). However, we did not find a multivariate group by time interaction for sleep quality or fatigue. Looking at the trajectory of the groups over time in Figure 4, it would appear that this may be accounted for by small increases in the control group over time, and that the intervention itself was having the expected effect on sleep quality and fatigue. These small albeit non-significant changes in the control group may have been enough to mask the differences in the groups on these variables, but could potentially be accounted for by survey effects, whereby repeated survey completion prompts self-regulation and increased self-awareness resulting in behavioural changes (Sitzmann & Wang, 2015).

Table 3. Tests of within-subject contrasts of the repeated measures MANOVAs run separately for the experimental group and the control group

		Pre vs. post				Pre vs. follow-up			
		F	df	*p*-value	Partial η^2	*F*	df	*p*-value	Partial η^2
Positive Affect	Control	0.036	1,88	*0.850*	0.00	2.916	1,88	*0.091*	0.03
	Experimental	**5.722**	**1,57**	***0.020***	**0.09**	**6.855**	**1,57**	***0.011***	**0.11**
Mindfulness	Control	2.131	1,88	*0.148*	0.02	0.294	1,88	*0.589*	0.00
	Experimental	**5.947**	**1,57**	***0.018***	**0.09**	**1.995**	**1,57**	***0.163***	**0.03**
Hope	Control	0.297	1,88	*0.587*	0.00	2.768	1,88	*0.100*	0.03
	Experimental	**15.687**	**1,57**	***0.000***	**0.22**	**12.08**	**1,57**	***0.001***	**0.18**
Work Engagement	Control	0.633	1,88	*0.428*	0.01	3.605	1,88	*0.061*	0.04
	Experimental	**8.635**	**1,57**	***0.005***	**0.13**	**6.337**	**1,57**	***0.015***	**0.10**
Fatigue	Control	0.000	1,88	*1.000*	0.00	0.439	1,88	*0.510*	0.01
	Experimental	**5.158**	**1,57**	***0.027***	**0.08**	**8.835**	**1,57**	***0.004***	**0.13**
Sleep	Control	1.802	1,88	*0.183*	0.02	7.679	1,88	*0.007*	0.08
	Experimental	**15.27**	**1,57**	***0.000***	**0.21**	**13.742**	**1,57**	***0.000***	**0.19**

Strengths and limitations

By integrating the broaden-and-build theory (Fredrickson, 2001) with the two-component model of mindfulness (Bishop et al., 2004), this study explains why PAIs in combination with mindfulness exercises are effective. It thus provides a solid theoretical rationale for future PAIs among employees.

For developing the intervention and making it as effective as possible, we built on existing research and theoretical assumptions. Research findings about moderating variables that make PAIs more effective, like variety or person-activity-fit were taken into account for the development of the intervention. This study actively involved participants in the selection of activities to guarantee for a high person-activity-fit. In this study, the different variables were not experimentally manipulated however. Future studies could experimentally manipulate variety, person-activity fit, or other variables like social support to examine whether they really have an influence on the effectivity of PAIs in the organizational context.

The study made use of self-report scales only. It can be argued that self-report can produce common method bias and biased answers due to social desirability (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Nevertheless, self-report measures are the most common method used in organizational contexts and can validly be used to assess feelings or attitudes about work aspects (Spector, 1994). We tried to avoid socially desirable answers by assuring participants that there are no right or wrong answers and that all questionnaires are anonymous. One may argue that sleep quality cannot be adequately assessed by self-report because of a lack of insight to own physiological processes, but there are studies that show correlations between self-reported sleep quality and objective physical measures like amygdala reactivity (Prather, Bogdan, & Hariri, 2013) and overall health (Akerstedt et al., 2007). This suggests that the measurement of sleep quality and fatigue in self-report is a valid indicator for objective health impairment. Further, the measurement of sleep quality and fatigue might be limited by the use of single item scales. However, the single item fatigue scale (van Hooff et al., 2007) is a widely used and validated measure. In addition, the single item scale to measure sleep quality has been shown to capture a recovery intervention's effectiveness (Hahn et al., 2011).

Intervention participants were instructed to conduct daily mindfulness exercises in week 1, and positive activity exercises in week 2 and 3. One limitation of the study is that we could not track when participants completed the exercises and have not evaluated if they liked the activity. Thus, future research should include a tracking system in intervention research and measure participants' preferences for different intervention activities.

Results indicate that the effects of the intervention can persist after the intervention is finished. The time lag of two weeks after the intervention for the follow-up measurement corresponds to time lags used in the majority of studies in similar topics (Richardson & Rothstein, 2008). To examine long-term effects of the intervention, it would be nevertheless desirable to measure the effects when more time after the intervention has passed.

Another limitation could be the small sample size and a potentially non-representative sample through self-selection. Especially in online studies, self-selection of participants can lead to biased samples. Only those who want to become happier and more engaged in their job register to the study. But research has shown that self-selection and effort are moderating variables in the positive-activity model making interventions more effective (Lyubomirsky & Layous, 2013). Therefore, self-selection leads to a biased sample but in a meaningful way. Only those who register want to increase their well-being at work. These participants are most likely to benefit from an intervention (Seligman et al., 2005). Apart

from self-selection and effort, we assured the generalizability of our sample by recruiting participants from different companies, industries, and regions through different channels like social networks, personal contacts, or newsletters.

Directions for future research

Mindfulness as a starter activity

The development of the intervention was based on the theoretical assumptions of the broaden-and-build theory (Fredrickson, 2001, 2008). We assumed that mindfulness exercises in the first module of the intervention would lead to a state of openness to experience and curiosity. This builds resources that are needed to effectively carry out positive activities in the further course of the intervention. Past research supports this assumption demonstrating that there are certain activities that are not very effective as a 'starter activity' (Layous, Nelson, et al., 2013). We also addressed the 'selection benefit paradox' as found by Ouweneel et al. (2013). Nevertheless, future research should investigate further this assumption by manipulating the order in which the exercises are carried out. In addition, future research should evaluate the distinct effects of intervention elements to evaluate distinct and combined effects of a multi-faceted intervention.

Reciprocal effects and upward spirals

One extension of the broaden-and-build theory is the triggering of upward spirals by positive emotions (Fredrickson & Joiner, 2002). Positive emotions create resources and resources lead to more positive activities. These positive activities in turn lead to an additional increase in resources making more positive activities likely. One study by Reis, Hoppe, and Schröder (2015) showed reciprocal effects between job resources, personal resources, health, and work engagement. Concerning intervention research, it has not been examined to date whether interventions can prompt such spiral effects, nor the appropriate 'dose' that is required to either maintain or increase such effects. Intervention activities performed over a number of weeks trigger these positive effects but more research is required to understand how these effects can be maintained and increased over time. For example, our research found sustained impact for the motivational variables (hope and work engagement) as well as the health impairment variables (fatigue and sleep quality) over two weeks. Future research could therefore examine long-term effects of brief interventions like the one developed here, as well as the optimal dose to keep participants engaged while also maintaining the effects of the activities.

Practical implications and conclusion

Positive psychology is increasingly transferred to the organizational context. Organizations are shifting their focus from merely maximizing the financial bottom line to increasing well-being, health, and engagement of their employees (Mills et al., 2013). Research shows that this focus is reasonable as there are causal relationships in terms of happiness or positive emotions leading to success (Lyubomirsky, King, & Diener, 2005). Positive effects of work engagement on work outcomes like turnover, in-role and extra-role performance, organizational commitment, and organizational profitability have also been found (Harter, Schmidt, & Hayes, 2002; Hu, Schaufeli, & Taris, 2011; Mills et al., 2013). Therefore, organizations are already investing money in interventions to promote well-being and engagement. The intervention developed and evaluated here indicates that

mindfulness and positive activities could be used to increase work engagement and hope. In addition, the intervention shows short-term improvements in sleep quality and fatigue.

This study also provides a theoretical framework for positive psychology interventions in an organizational context. An online intervention like the one that was developed here is a very cost-effective way to train a large number of people at the same time. Therefore, it conveys an easy-to-use method for organizations to provide work engagement, hope, and improve sleep quality in employees. However, as noted by Hülsheger (2015), such interventions should not be seen as a quick fix for organizations, nor as a viable alternative for ignoring underlying structural problems in organizations. Moreover, we should not ignore the key role of cultural contexts across the world, specifically when applying research executed with participants predominantly from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies (Henrich, Heine, & Norenzayan, 2010) to non-WEIRD employees.

In sum, this research contributes to adapting PAIs to an organizational context. The intervention developed and evaluated here was effective in increasing motivational variables and sleep quality as well as reducing fatigue as indicators of health impairment in a working sample.

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Conflicts of interest

All authors declare no conflict of interest.

Author contributions

Alexandra Michel, Ph. D. (Conceptualization; Methodology; Supervision; Writing – original draft; Writing – review & editing) Clarissa Groß (Data curation; Formal analysis; Methodology; Writing – original draft) Annekatrin Hoppe (Conceptualization; Methodology; Supervision; Writing – review & editing) M. Gloria Gonzalez-Morales (Conceptualization; Methodology; Writing – original draft; Writing – review & editing) Anna Steidle (Conceptualization; Methodology; Writing – review & editing) Deirdre O'Shea (Conceptualization; Methodology; Writing – original draft; Writing – review & editing).

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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